

EXPERIMENT 4

ALKA-SELTZER VARIABLE TEST TO IMPROVE SPEED OF DISSIPATION

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Presenters in order of appearance: Marielle Billig, Andrew Blank,
Ross Steinberg, Daniel Newman, Kim Hill, Natalie Knez

We established these variables as controls for all testing unless that specific variable was being tested.

½ tablet

100 mL beaker

15 mL tap water

only using cold water handle from sink

times measured from point of tablet-water contact to moment
when tablet is no longer discernible as a solid

GROUP I: SURFACE AREA

Marielle Billig

Matt Coleman

Jeremy Kriska

Kathryn Jancaus

SURFACE AREA

- Manipulated Variable: the ratio of surface area to mass of the tablet
- By breaking tablet into smaller pieces, the surface area is increased while the mass remains the same.
- Hypothesis: If the surface area to mass ratio was increased, then the time it would take for the tablet to dissolve would decrease.

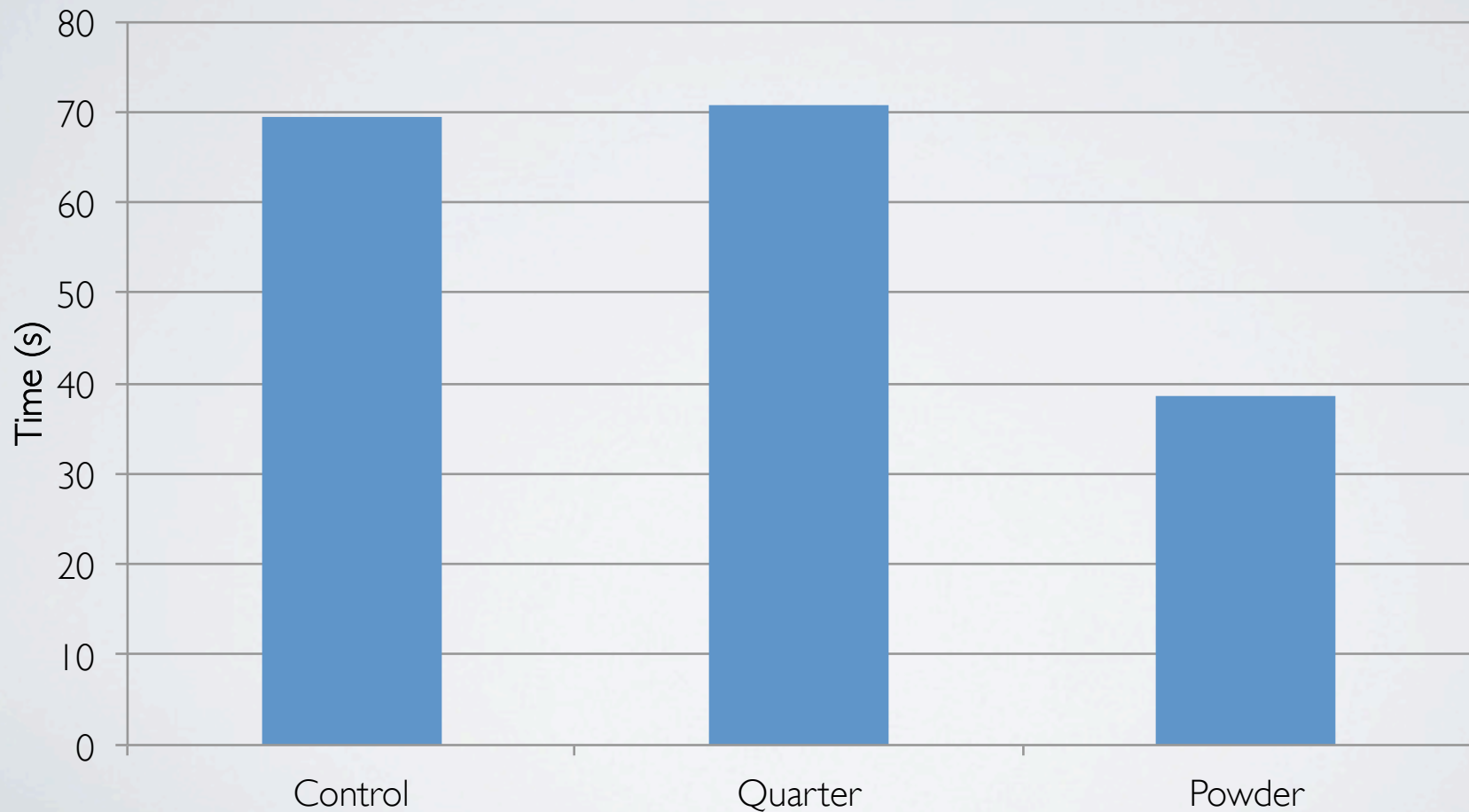
SURFACE AREA DATA TABLES

Quarters	
Trial	Time to Dissolve (seconds)
1	63.66
2	68.73
3	83.46
4	67.57
Average Time (seconds)	70.855
Standard Deviation	8.678726865

Powered	
Trial	Time to Dissolve (seconds)
1	26.95
2	45.86
3	42.64
Average Time (seconds)	38.48333333
Standard Deviation	10.11708621

Control	
Trial	Time to Dissolve (seconds)
1	69.33
2	70.23
3	68.46
Average Time (seconds)	69.34
Standard Deviation	0.885042372

SURFACE AREA GRAPH



SURFACE AREA

- The data supports the hypothesis.
- The point when the powder is completely dissolved is not obvious and therefore challenging to measure.
- When the tablet is cut into quarters, some of the tablet crumbles off.
- If the experiment were to be conducted again, we would use more precise measuring techniques.

GROUP 2: LIQUID TYPE

Sam Crowe
Matthew Kabelitz
Ethan Matlin
Joseph Nieman
Andrew Blank

LIQUID TYPE

Variables

- Independent variable: type of liquid used to dissolve tablet
- Dependent variable: time for tablet to dissolve

Hypothesis

- We predicted that if we tested four different types of liquid, regular tap water, distilled water, carbonated water, and lemon juice, then the tablet would dissolve in the least amount of time in the carbonated water.

Group 2

DATA

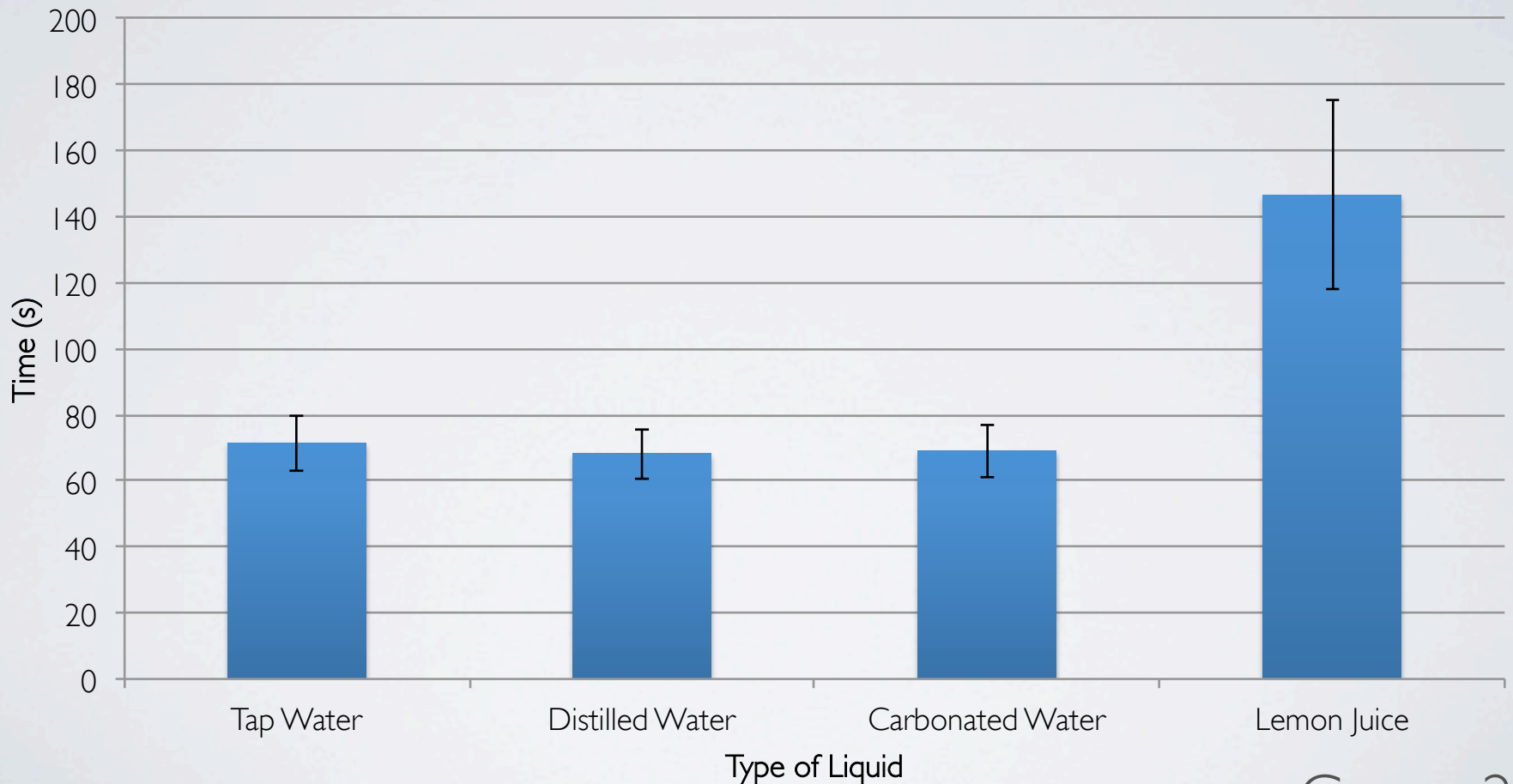
	Time for tablet to dissolve in 15mL of tap water (s)	Time for tablet to dissolve in 15mL of distilled water (s)	Time for tablet to dissolve in 15mL of carbonated water* (s)	Time for tablet to dissolve in 15mL of lemon juice (s)
Trial 1	60.75	76.69	69.51	170.42
Trial 2	79.08	70.78	57.78	115.03
Trial 3	81.28	58.51	73.28	154.22
Trial 4	67.34	67.01	75.88	N/A
Trial 5	68.52	N/A	N/A	N/A
Mean	71.39	68.25	69.11	146.56
Standard Deviation.	8.58	7.62	7.99	28.48

*Ice Mountain™ Sparkling Water

Group 2

GRAPH AND ANALYSIS

Average time for tablet to dissolve in different liquids



Group 2

DISCUSSION

- We were not happy with some of our data because we encountered large variances.
- Our main source of error was cutting up the tablets — the time was noticeably faster when the tablet had broken in the cutting process
- From our data we conclude that lemon juice takes the most time to dissolve, and distilled water seems to have the fastest dissolve-time, however, this could be due to error.
- If we could repeat this experiment, we would like to use whole tablets instead of half tablets to avoid the problem of breaking tablets.

Group 2

GROUP 3: WATER TEMPERATURE

Matthew Bondy

Ross Steinberg

Dylan Ekenberg

Edward Kang

Tommy Muldoon

TEMPERATURE OF WATER

- Manipulated Variable: the temperature of the water
- Three temperatures were used: a temperature of 18.2°C for the faucet water, a temperature of 85.6°C for the hot plate water, and a temperature of 4.5°C for the ice-bath water.
- Hypothesis: If the temperature of the water increases, the tablet will dissolve more quickly.

Group 3

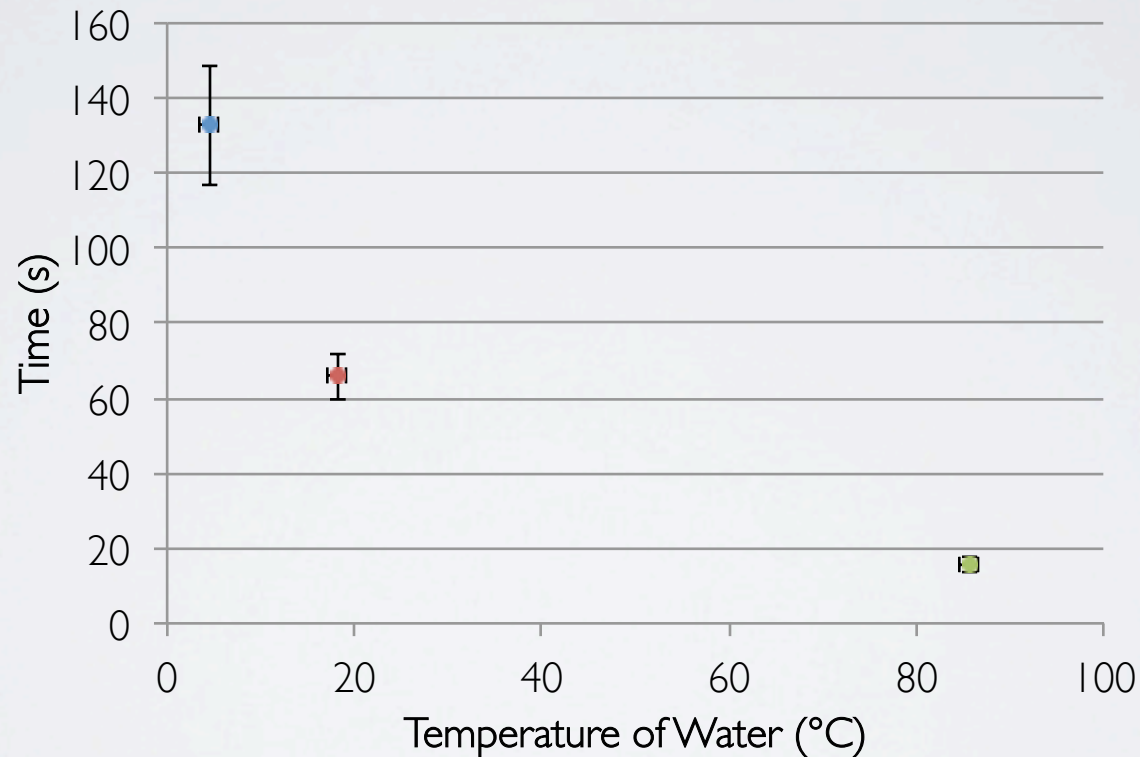
Time for Tablet to Dissolve in Seconds

	Tap Water	Hot Water	Cold Water
Trial 1	65.5	18.1	150.2
Trial 2	72.2	15.2	119.6
Trial 3	59.6	14.0	128.1
Mean	65.8	15.8	132.6
STDEV	6.3	2.1	15.8

Group 3

GRAPH

Effect of Water Temperature on Dissolving Time of Alka-Seltzer



Group 3

ANALYSIS

- The data ended up supporting our hypothesis that the tablet would dissolve the fastest in hot water.
- We experienced some difficulty measuring out the exact same amount of water each time, deciding exactly when the tablet was completely gone, and making sure the water was exactly the same temperature for each trial.
- Next time, we could have multiple trials conducted by different people at the same time to make sure that the water was the same temperature. We could also develop an even more specific definition of when to stop the timer.

Group 3

GROUP 4: AMOUNT OF WATER

Daniel Newman

Alex Kaplan

Nolan Gruemmer

Shoshi Center

Jonny Wagner

AMOUNT OF WATER

- Manipulated variable: amount of water
- The amount of water changed by increments of 15mL (15mL, 30mL, 45mL)
- Hypothesis: If more water is added to the beaker, the time it takes for the tablet to dissolve will decrease

Group 4

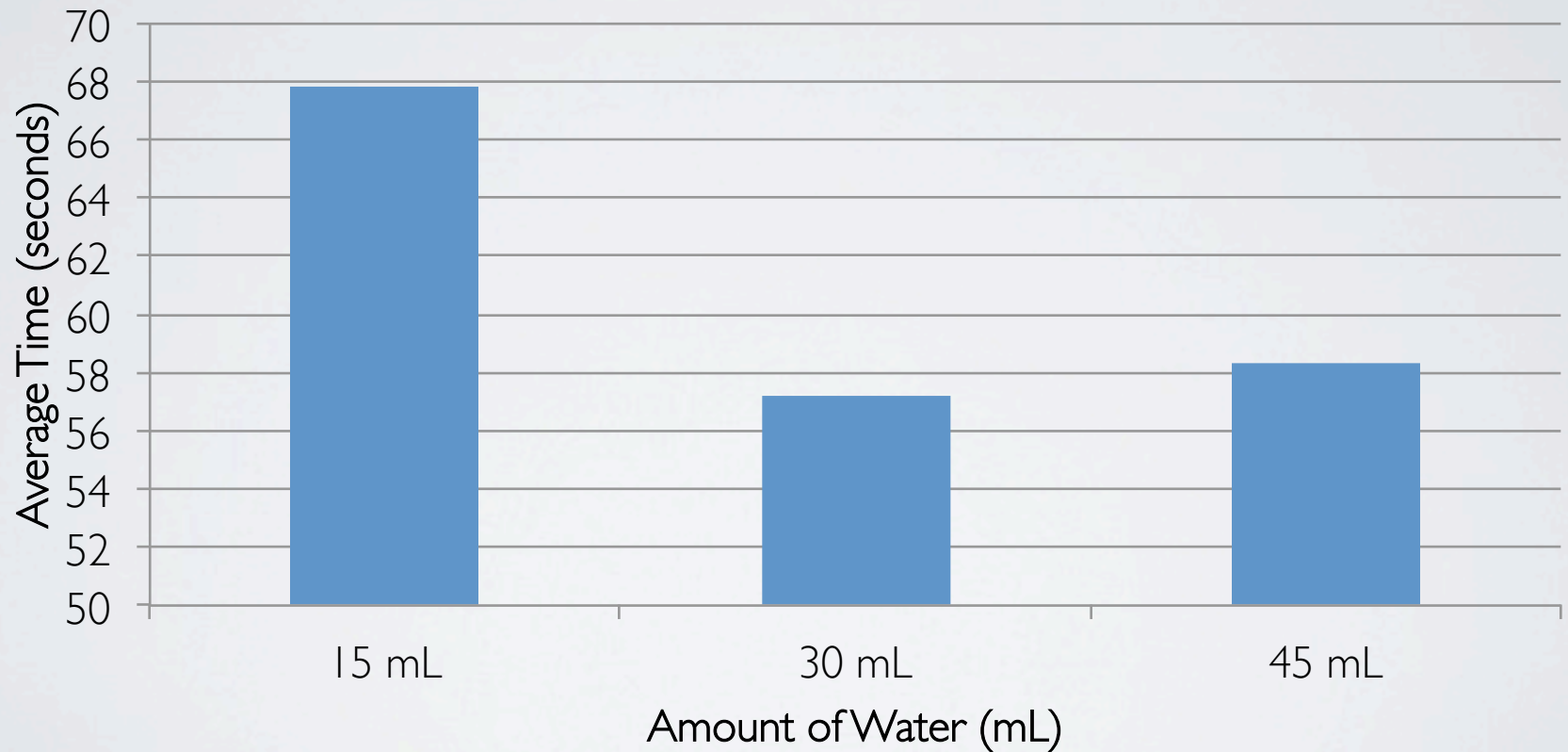
DATA

Amount of Water (mL)	Time Trial One (seconds)	Time Trial Two (seconds)	Time Trial Three (seconds)	Time Trial Four (seconds)	Average (seconds)	Standard Deviation
15 mL	74.7	67.2	55.3	74.1	67.8	9.02
30mL	51.7	65.1	59.2	52.6	57.2	6.27
45mL	55.7	60.5	56.5	60.5	58.3	2.56

Group 4

GRAPHICAL ANALYSIS

Series I



Group 4

DISCUSSION

- Our data does not entirely support our hypothesis. The amount of water is fairly irrelevant on how long it takes the tablet to dissolve.
- It was difficult to tell when exactly the tablet completely dissolved.
- Not much could have been done to improve the accuracy and precision of our data.

Group 4

GROUP 5: TEMPERATURE OF TABLET

Jeremy Chin

Kim Hill

Arin Kerstein

Kevin Ray

TEMPERATURE OF TABLET

- Manipulated Variable: temperature of tablet
- Temperatures included were freezing, refrigerated, room temperature and heated.
- If the temperature of the tablet is increased, then it will dissolve faster.

Group 5

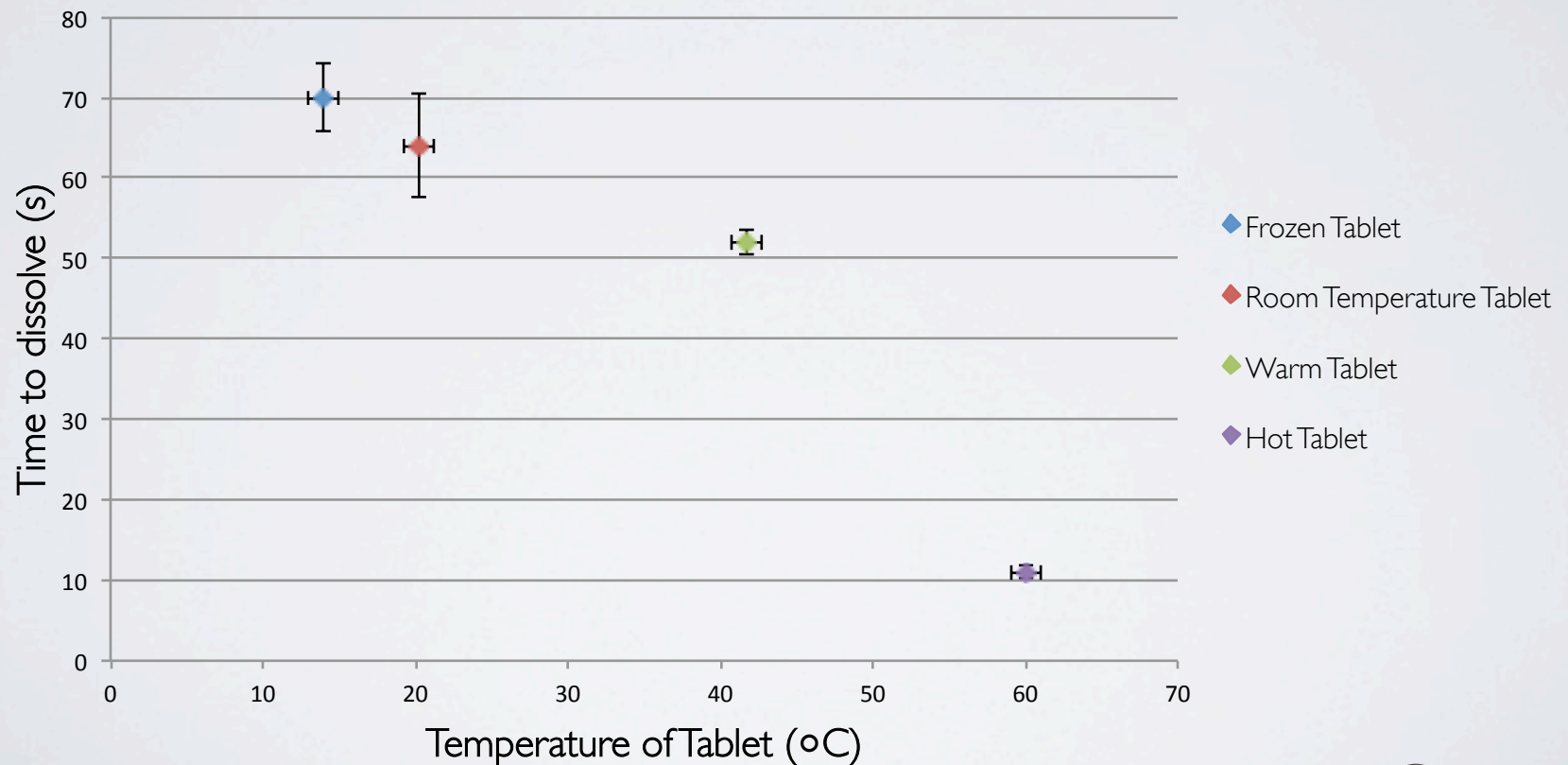
DATA TABLE

	Freezing (14.0 °C)	Control (20.2 °C)	Hot Plate 1 (41.7 °C)	Hot Plate 2 (60.01 °C)
Trial 1	75	64	53	10
Trial 2	65	76	53	11
Trial 3	68	72	50	12
Trial 4	70	64	51	11
St. Dev.	4.2	6.0	1.5	0.82
Mean	70	69	52	11

Group 5

GRAPHICAL ANALYSIS

Effect of Tablet Temperature on Dissolving Time of Alka-Seltzer



Group 5

DISCUSSION

- The data collected did support our hypothesis, which was that hotter tablets will dissolve more quickly.
- However, at temperatures at or above 50 °C, the tablets began to melt and boil
- In the future, we would not heat tablets above 50 °C, and we'd test more temperatures of tablets.

Group 5

GROUP 6: ORDER OF OPERATION

Natalie Knez

Courtney Chron

Nadia Homedi

Josh Simone

ORDER OF OPERATION

- Manipulated Variable: Order of Operation
- One: The tablet was placed in the water
- Two: The water was poured on the tablet
- Hypothesis: If $\frac{1}{2}$ tablet is dropped into 15mL of tap water, it will dissolve faster than if 15 mL of tap water is poured on $\frac{1}{2}$ tablet of water.



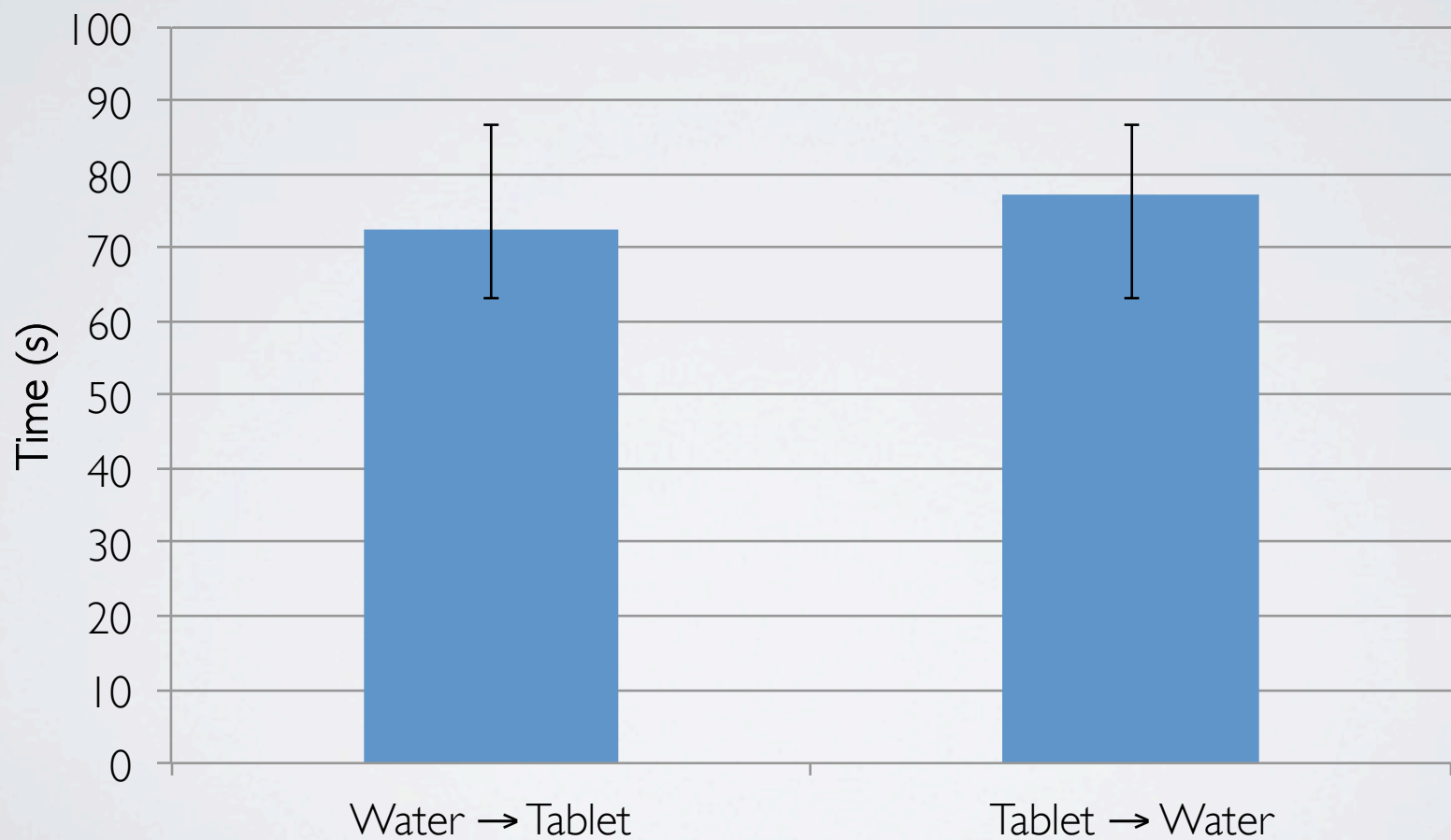
Group 6

DATA TABLE

	Water → Tablet	Tablet → Water
Trial 1	70.2 s	75.6 s
Trial 2	75.0 s	80.6 s
Trial 3	68.7 s	73.1 s
Trial 4	74.3 s	80.4 s
Mean	72.5 s	77.4 s
Standard Deviation	3.01	3.70

Group 6

GRAPH



Group 6

DISCUSSION

- The data does support the original hypothesis. Placing the tablet in the water causes the alka seltzer to dissolve 4.9 seconds faster.
- Cutting the tablets in half and determining when exactly the tablet was dissolved were difficulties affecting our experiment.
- In the future using a whole tablet during our experiment would avoid the problem of cutting it inconsistently.

Group 6

RECOMMENDATIONS FOR LABEL

- The user would benefit from breaking the tablet into very small pieces before dissolving it in the water if he/she wanted the fastest time.
- The user should dissolve the tablet in carbonated water.
- The tablet should be dissolved in warmer (or hotter) water.
- The tablet should be put in a glass with enough water to fully submerge the tablet.
- The tablet should be heated to around 40°C for quicker results.
- The tablet should be placed in the water.

Presentation on behalf of Grdinic (8-9)A